

HARDWARE MANUAL

LX1NSERIES PROGRAMMABLE CONTROLLERS

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Foreword

- This manual contains text, diagrams and explanations which will guide the reader in the correct installation and operation of the LX1N Series Programmable Controllers. It should be read and understood before attempting to install or use the unit.
- If in doubt at any stage of the installation of an LX1N Series Programmable Controller always consult a professional electrical engineer who is qualified and trained to the local and national standards which apply to the installation site.
- If in doubt about the operation or use of LX1N Series Programmable Controller please consult the nearest Mitsubishi Electric distributor.
- This manual is subject to change without notice.

LX1N SERIES PROGRAMMING CAUTION

Thank you for buying The HCFALX1N series controller.

Please note the following.

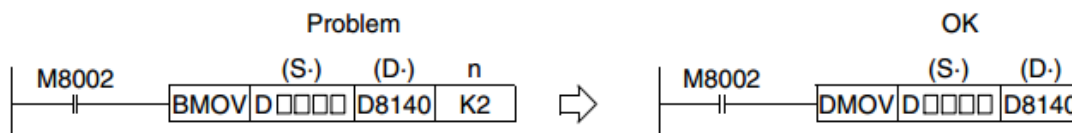
Notes: Block Move instruction

Applicable PLC: LX1NVer 1.00-2.10

Applicable instructions: BMOV, BMOVP(FNC15)

If the file register parameter setting and the registers D8000-D8225 are used as the destination devices for the BMOV (BMOVP) instruction, program steps or file register data may be lost or damaged. All other data registers can be used safely for BMOV(BMOVP) instruction destination registers.

Program example



Guidelines for the safety of the user and protection of the LX1N.

This manual provides information for the installation and use of the LX1N. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;

- Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, (trained and qualified to the local and national standards required to fulfill that role). These engineers should be fully aware of all aspects of safety with regards to automated equipment.
- Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.
- All operators of the completed equipment (see Note) should be trained to use that

product in a safe manner in compliance to established safety practices. The operators should also be familiar with documentation which is associated with the operation of the completed equipment.

Note :The term 'completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual.

Note's on the symbols used in this manual

At various times throughout this manual certain symbols will be used to highlight points of information which are intended to ensure the users' personal safety and protect the integrity of the equipment. Whenever any of the following symbols are encountered, its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

Hardware warnings



1) Indicates that the identified danger WILL cause physical and property damage.



2) Indicates that the identified danger could POSSIBLY cause physical and property damage.



3) Indicates a point of further interest or further explanation.

Software warning



1) Indicates special care must be taken when using this element of software.



2) Indicates a special point which the user of the associate software element should be aware of.



3) Indicates a point of interest or further explanation.

- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Please contact a Mitsubishi Electric distributor for more information concerning applications in life critical situations or high reliability.

Note Concerning the CE Marking

This document does not guarantee that a mechanical system including this product will comply with the following standards. Compliance to EMC directive and LVD directive of the entire mechanical system should be checked by the user / manufacturer.

For more details please contact the local Mitsubishi Electric sales site.

Programmable logic controllers are open-type devices that must be installed and used within conductive control boxes.

Please use the LX1N Series programmable logic controllers while installed in conductive shielded control boxes.

Please secure the control box lid to the control box (for conduction).

Installation within a control box greatly affects the safety of the system and aids in shielding noise from the programmable logic controller.

1. Introduction

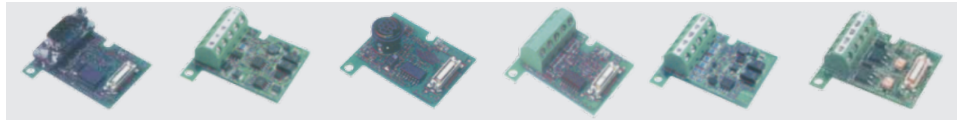
This manual covers hardware installation instructions for the LX1N Series PLC.

Table 1.1: LX1N Main Unit

Function Expansion Board

Communication blocks

Special function blocks



RS_232C block

RS_485 block

RS_422 block

Analogue input/output block

4 points input & 2 points output block

LX1N Basic Units

■ AC Power Supply
 ■ DC Power Supply
 ■ DC INPUT
 ■ Relay output
 ■ Transistor output



Points	L(mm)	W(mm)	H(mm)
LX1N-24MR(T)(24 points)	130.2	90	81
LX1N-40MR(T)(40 points)	182.2	90	83
LX1N-60MR(T)(60 points)	220.2	90	83

Table 1.1: Powered Extension Blocks

■Input Expansion Block	■Output Expansion Block	■Special Expansion Block/Analog Unit		Input & output expansion block	Positioning Control block	Analogue block
TX2N-8EX TX2N-16EX	TX2N-8EYR TX2N-8EYT TX2N-16EYR TX2N-16EYT	A/D TX2N-2AD TX2N-4AD TX2N-8AD	D/A TX2N-2DA TX2N-4DA	TX2N-8ER TX2N-16ER TX2N-8ET	TX2N-1PG TX2N-4PG TX2N-10PG TX2N-1RM-SET TX2N-10GM TX2N-20GM	TX0N-3A TX2N-4AD-4DA TX2N-4AD-2DA TX2N-4AD-TC TX2N-4AD-PT TX2N-2LC TX2N-1HC

1.1 Rules of Expansion

The maximum I/O for an LX1Nsystem is 128 I/O points and 8 special function blocks.

The LX1NSeries can be expanded as follows when used independently.

- 2 special function blocks
- 1 special function block and up to 16 I/O points
- Up to 32 I/O points

An AC powered LX1Ncan be expanded by 8 special function blocks when used in conjunction with an HCA5extension unit (2+6).

- If a DC powered main unit is used with a power supply of less than 24VDC -15% (20.4V DC or less), then it cannot be fully expanded by using special function blocks or powered extension units.

It can accommodate a maximum of an additional 32 I/O points.

- If an LX1Nexpansion board is being used, it does not alter the rules of expansion outlined above, as it utilizes special M coils for its operation and therefore does not contribute to the maximum 128 I/O point count. Only one special function board can be used at any time.

See section 3.8 for more details.

1.2 Back up Data

1.2.1 EEPROM backup

Data includes the Program, Comment, File Registers (D1000 ~ D7999), and parameter data.

This will be stored as long as the EEPROM is not damaged. Mitsubishi Electric has guaranteed a life cycle time of 10,000 writes to the EEPROM memory. Users may experience operational writes to the EEPROM in excess of 10,000; however, due to temperature effects a quantitative estimation cannot be given.

When saving the device status in the EEPROM, the electric power of the PLC's built-in capacitor is used.

If the PLC has been powered on for five minutes or more, the following device data will be saved in the EEPROM at power down: S0 ~ S127, M384 ~ M511, C16 ~ C31, C235 ~C255, and D128 ~ D255.

When the EEPROM keep device status cannot be correctly saved to the EEPROM by shortage of electric charge, at the next power-on the status of the device will be that which saved to the EEPROM at the last save.

1.2.2 Capacitor backup

The capacitor backed memory includes M512 ~ M1535, S128 ~ S999, T246 ~ T255, C32 ~ C199, C220 ~ C234, D256 ~ D7999 and the RTC.

The capacitor backed memory will retain data for a maximum of 10 days (Ambient

temperature: 25 °C), and requires 30 minutes to recharge upon power up.

Note: The LX1N does not have battery backup, if a system requires backup of more than 10 days (Ambient temperature: 25 °C), a peripheral backup power source must be provided.

1.2.3 Initialize Latched (Keep) Devices

- When using non-latched devices

To use the latched devices as the non-latched devices, reset the latched devices by an initial pulse (M8002) in program.

- When using capacitor latched (keep) devices

If the voltage of a capacitor drops, the capacitor keep device status may be stored incorrectly. Therefore, when using the PLC after it has been powered off for more than 10 days (Ambient temperature: 25 °C), re-set up the required devices and the current time after initializing capacitor latched (keep) devices before selecting RUN.

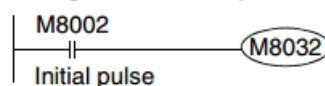
Initialization method

Latched (keep) devices can be initialized in the PLC memory by using peripheral equipment, and the special auxiliary relay M8032, or executing the ZRST instruction. The two major methods are described below.

- Latch memory all clear by special auxiliary relay (M8032)

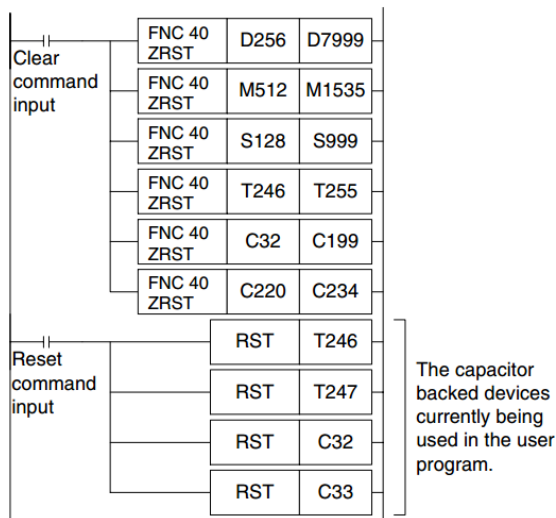
When M8032 is turned ON, all latched (keep) devices (including reset coils of timers and counters) are cleared. M8032 can be turned ON and OFF using the forced ON/OFF operation from peripheral equipment or within the sequence program. Note that latched devices cannot be turned ON while M8032 is ON. When turning ON M8032 within the sequence program, note that latched devices are cleared during END processing after M8032 is turned ON.

Program example: This program clears all latched devices.



- Reset of device by ZRST (zone reset) instruction

The ZRST instruction can clear multiple devices at once. (Because a limited device range can be specified for the ZRST instruction, only part of the latched (keep) devices can be cleared at a time.)



However, initialization method by the ZRST instruction for capacitor backed timer and counter devices

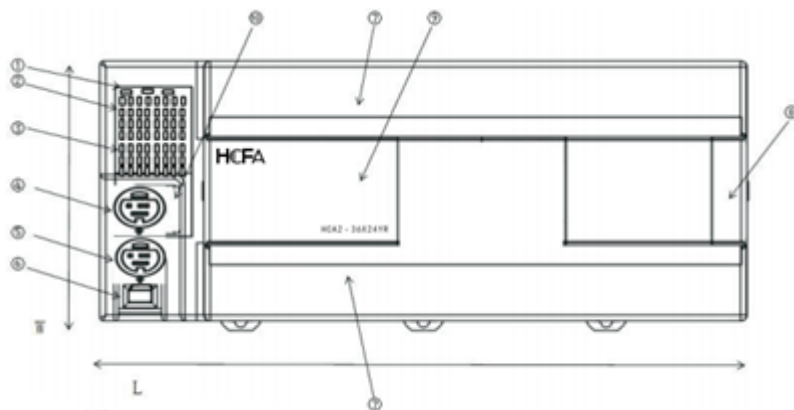
(T246 ~ T255, C32 ~ C199, C220 ~ C234)
does not reset the associated coil devices.
In order to initialize the associated coil
devices, execute the RST instruction for
the coil devices being used in the user
program as shown in the example program
on the left.

2. Installation Notes

The installation of LX1N products has been designed to be safe and easy. When the products associated with this manual are used as a system or individually, they must be installed in a suitable enclosure. The enclosure should be selected and installed in accordance to the local and national standards.

2.1 Product Outline

Figure 2.1: Features of the LX1N PLC



- ①Status indicator POWER LED: power-up state
RUN LED: running lights
ERROR LED: When program error, indicating lamp twinkles
When CPU error, indicating lamp lights
- ②Input indicator: LX1N is octal.

- ③Output indicator: LX1N is octal.
- ④RS422&485 communication port: Operating according to arrow direction
- ⑤RS422 communication port: Operating according to arrow direction
- ⑥RUN/STOP switch
- ⑦Terminal cover
- ⑧The right expansion cover
- ⑨The front cover, built-in battery interface
- ⑨Two analog potentiometer opening

2.2 LX1NRUN/STOP Control

RUN or STOP of the LX1N can be controlled by:

- ①The RUN/STOP switch mounted next to the programming port.
- ②A standard input (X0 to X17) defined by the system parameters.
- ③Remotely from a personal computer or other programming peripheral



Note: The LX1NRUN/STOP switch works in parallel with the RUN-input terminal. Please refer to the table below.

During remote operation the LX1NRUN/STOP status is determined by the most recently operated control.

E.g. If the RUN/STOP switch is in RUN and a remote STOP is made from a personal computer the RUN/STOP switch must be switched to STOP then back to RUN to switch the MPU back to RUN mode

Figure 2.2:RUN input terminal

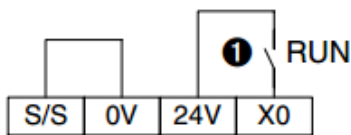


Table : RUN/STOP selection

RUN/STOP SWITCH	① RUN INPUT TERMINAL	LX1N MPU STATUS
RUN	ON	RUN
RUN	OFF	RUN
STOP	OFF	STOP
STOP	ON	RUN

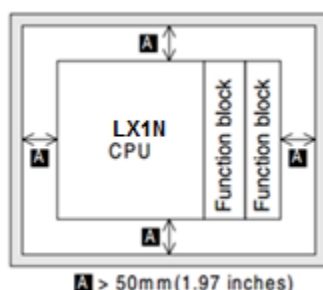
2.3 General Specifications

	Item	Specification
Power supply	Power supply	AC POWERED MODULE:100~240V AC DC POWERED MODULE:DC24V
	Power consumption	AC POWERED MODULE:30W(24M),32W(40M),35W(60M) DC POWERED MODULE:15W(24M),18W(40M),20W(60M)
	In-rush current	AC POWERED MODULE:30A (max.)/5ms(at AC100V),50A/5ms(at AC200V) DC POWERED MODULE:25A(max.)/1ms(at DC24V), 22A/0.3ms(at DC12V)
	Power supply(DC24V)	AC POWERED MODULE:DC24V 400mA
	Input Spec.	DC24V 7mA/5mA
	Output Spec.	Relay output:2A/1 point,8A/4points COM ≤AC250V, ≤DC30V Transistor output:0.5A/1 point,0.8A/4 points COM DC5V~30V
	I/O & Special function expansion	Increase digital or analogue I/O points with expansion board
Performance	Program memory	8,000 steps of built-in program memory (EEPROM),no battery Transmit storage box available
	Time function	Integrated real-time clock
	Instruction	Standard:27 step ladder:2 special function:89
	Cycle time per log. Instruction	Standard:0.5~0.7μs special:3.7~hundreds μs
	High speed processing	I/O refresh instruction is available
	Max integrated I/O point	134 points
	Auxiliary relay& timers	Auxiliary relay:1,536 points timer:256 points
	Counter	General:200 points(16 bit) 35 points(32 bit) High speed counters: (1 phase)60KHz/2 points,10KHz/4 points(2 phase),30KHz/1 point,5KHz/1point
Others	Data registers	General:8,000 points,Index:16 points,File:7,000 points(max.)
	Analog potentiometer	Built-in 2 points
	Internal communication interface	RS422
	communication	RS-232C,RS-485,RS-422,N:Nnet,parallel link, PC communication

2.4 PLC Mounting Arrangements

To prevent a rise in temperature, mount the units to walls. Never mount them to the floor or ceiling of an enclosure.

Below (left) Single row arrangement



Caution

- Units should not be installed in areas subject to the following conditions: excessive or conductive dust, corrosive gas (salt air, Cl₂, H₂S, SO₂, NO₂, etc.) or flammable gas,

moisture or rain, excessive heat, regular impact shocks or excessive vibration.

- Take special care not to allow debris to fall inside the unit during installation e.g. cut wires, shavings etc. Once installation is complete remove the protective paper band, to prevent overheating.
- Always ensure that mounted units and blocks are kept as far away as possible from high-voltage cables, high-voltage equipment and power equipment.
- Do not lay signal cables near high voltage power cabling or cabinet housing along the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables of more than 100 mm (3.94") away from these power cables.
- Install necessary power supply cut off precautions to the enclosure of the final system. Attach a warning label (hazard symbol 417-IEC-5036) concerning electric shock to the enclosure.
- Use the LX1Nseries PLC with consideration for electrical noise in an environment that does not exceed conditions provided by EN50081-2 and EN61000-6-2.
- Cut off all phases from the power source before installation or performing wiring work to avoid electric shock. Incorrect operation can lead to serious damage to the product.
- Cut off all phases from the power source before installing/removing extension or communication cables to modules to avoid electric shock, incorrect operation or serious damage to the product.
- Replace the terminal cover provided, after installation or wiring work is completed, and before supplying power and operating the unit to avoid electric shock.
- After reading the manual's safety instructions, initiate the operation for making program changes while the PLC is in RUN mode, forcing ON/OFF and switching RUN/STOP.
- The power supply of the extension units/blocks and the special function units/blocks should be started at the same time or earlier than the LX1NSeries main unit.
- DO NOT use the “●” terminal in PLC.
- When using an incorrect power source or performing incorrect operation, serious damage will occur regardless of the level of the voltage and frequency.
- When performing incorrect wiring or operation, serious damage will occur.
- The “L” and “N” terminals are not reversible.

If the “L” and “N” terminals are reversed, the units/blocks may be seriously damaged.

- The “24V” and “0V” terminals are not reversible.

If the “24V” and “0V” terminals are reversed, the units/blocks may be seriously damaged.

- During transportation avoid any impact as the PLC is a precision instrument.

It is necessary to check the operation of PLC after transportation, in case of any impact damage.

- When storing the PLC, conform to the environmental conditions specified by the general specification.

2.5 DIN Rail Mounting

Units can be snap mounted to 35mm (1.37") DIN rail (DIN 46277). To release, pull the spring loaded clips away from the rail and slide the unit up and off.

2.6 Direct Mounting

Table :Hole positions

UNIT		mm ± 0.2	inches ± 0.01
A = W-8mm (0.32")			
LX1N-24M☆	2- ϕ ($\rightarrow$)	82	3.23
LX1N-40M☆		122	4.81
LX1N-60M☆		167	6.58

$\phi = 4.5\text{mm}$ (0.17")



• Make sure to turn OFF the power before installing this product.

2.7 Wiring

2.7.1 Termination at Screw Terminals

Terminal screws should be tightened to between 0.5 to 0.8 N.m. Terminal screws must be secured to prevent a loose connection thus avoiding a malfunction.

The terminal screws for the LX1N, HCA5 Series PLCs are M3.0. When installing 1 or 2 crimp terminals to a terminal, see explanation Figure 2.5 and 2.8.

However, 3 crimp terminals or more should not be installed to a single terminal.

1) Handle the crimp terminal of the following size when 1 wire is used per terminal. Refer to

Figure 2.5 for installation instructions

Figure 2.3: Crimp Terminal for M3.5 Screws

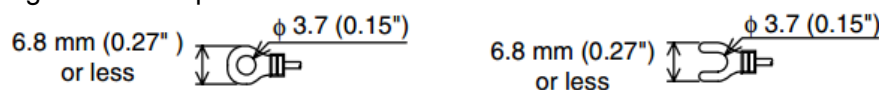


Figure 2.4: Crimp Terminal for M3 Screws

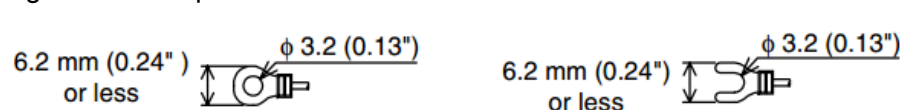
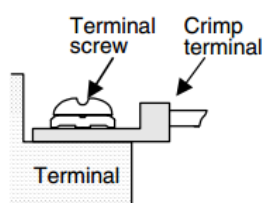


Figure 2.5: Installing 1 wire Per a Terminal



2) Handle the crimp terminal of the following size when 2 wires are used per terminal.

Refer to Figure 2.8 for installation instructions.

Figure 2.6: Crimp Terminal for M3.5 Screws

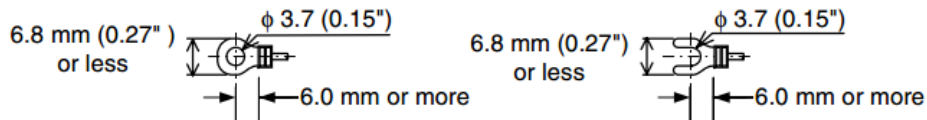


Figure 2.7: Crimp Terminal for M3 Screws

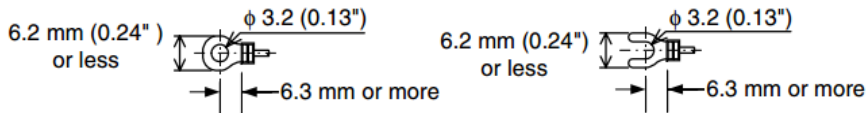
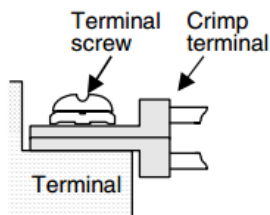


Figure 2.8: Installing 2 Wires Per a Terminal

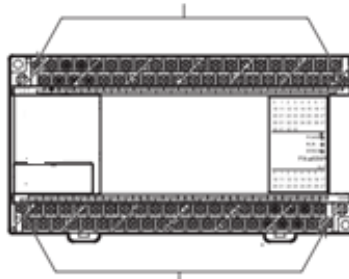


Caution: Make sure to turn OFF the power before starting any wiring work.

2.7.2 Removal and installation of quick-release terminal block

- **Removal** : Loosen the left and right screws evenly.
- **Installation** : Tighten the left and right screws evenly.
Tightening torque 0.4 to 0.5 N•m
Make sure that the center of the terminal block is not lifted

Loosen these left and right screws evenly to remove input terminals.



Loosen these left and right screws evenly to remove output terminals.

2.8 Installing Optional Units

2.8.1 Expansion Boards

The following is a generic explanation of how to install an expansion board on to the

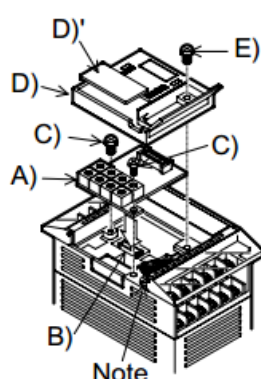
LX1NPLC.

For greater detail, specifications and wiring examples for each optional unit, please see the relevant product manuals.

MODEL	USE WITH TX1N-EEPROM-8L	USE WITH TX1N-BAT
TX1N-EEPROM-8L	X	X
TX1N-232-BD	Possible for program upload and download while the PLC is in the STOP mode	Standard life of TX1N-BAT: 2 years (at ambient temperature of 25 °C (77 °F)) For details on installation and maintenance, etc., refer to the TX1N-BAT USER'S MANUAL
TX1N-422-BD		
TX1N-485-BD		
TX1N-4EX2EYT-BD		
TX1N-2AD-BD		
TX1N-1DA-BD		
TX1N-BAT	X	X

Always make sure the power is turned off, before installing a special function board. Only oneboard can be used at any one time, do not try to stack multiple boards.

A) Special function or optional equipment board.



B) Optional equipment connector port.

C) M3 screw to secure board.

D) Top cover for board.

E) M3 screw to secure top cover.

Note: Do not remove this screw.

- Remove base unit top cover.
- Plug board A) into connector B).
- Fix board to base unit using screws C).
- Attach top cover for board D) removing section D)' to expose connector etc. (if applicable)

- Secure top cover with M3 screw E)

3. Power Supply

3.1 Wiring Techniques

Wiring for LX1N products has been designed to be safe and easy. If the user is concerned about the correct installation of these products or associated products, please contact a professional electrician who is trained to the local and national standards applicable to the installation site.

3.2 Wiring Cautions



- Do not run input signals in the same multicore cable as output signals or allow them to share the same wire.
- Do not lay I/O signal cables next to power cables or allow them to share the same trunking duct. Low voltage cables should be reliably separated or insulated with regard to high voltage cabling.
- Where I/O signal lines are used over an extended distance consideration for voltage drop and noise interference should be made.

3.3 Power Supply



• When wiring an AC supply, the “Live” cable should be connected to the “L” terminal and the

“Neutral” cable should be connected to the “N” terminal. Do NOT connect the “Live” wire to the “N” terminal, otherwise, the user may receive a dangerous shock upon powerup.

• When wiring a DC supply the “Live” cable should be connected to the “+” terminal and the

“Neutral” cable should be connected to the “-” terminal. Do NOT connect the “Live” wire to the “-” terminal, otherwise, the user may receive a dangerous shock upon powerup.

• When using a DC power supply type, it is the power source for an input extension block between “24V” and “0V” terminals.

Never supply an external power supply to these terminals.

Moreover, do not connect any equipment except an extension block to these terminals.

• Never connect the “0V” and the “-” terminals of a DC power supply type main unit.

3.4 Power Requirements

*1 Includes the input current (5 or 7mA per point).

*1 Includes the input current (5 or 7mA per point).

Table 4.1 : AC Power Supply Units

	LX1N-24MR(T)	LX1N-40MR(T)	LX1N-64MR(T)
Power supply	100 - 240V AC +10%, -15%, 50-60Hz		
Max. allowable momentary power failure period	10ms; if less than 10ms, the PLC will continue operation. If 10ms or more, the PLC will shut down		
Fuse (size) rating	250V 1A	250V 3.15A (3A)	

In-rush current	100V AC - Max. 30A for 5ms 200V AC - Max. 50A for 5ms		
Power consumption	30W*1	32W*1	35W*1
24V DC Service Supply	400 mA		

*1 Includes the input current(5 or 7mA per point).

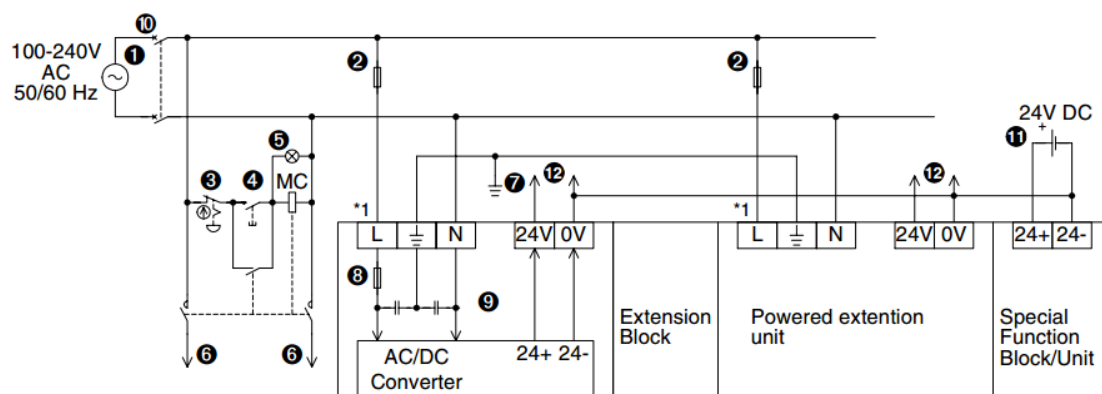
Table 4.2 :DC Power Supply Units

	LX1N-24MR(T)	LX1N-40MR(T)	LX1N-64MR(T)
Power supply	12 - 24V DC +20%, -15% (10.2 - 28.8V DC)		
Max. allowable momentary power failure period	5 ms; If less than 5 ms, the PLC will continue operation. If 5 ms or more, the PLC will shut down		
Fuse (size) rating	125 V 3.15A		
In-rush current	24V DC - Max. 25A for 1ms 12V DC - Max. 22A for 0.3ms		
Power consumption*1	15W	18W	20W

*1 Includes the input current (5 or 7mA per point).

3.5 Example Wiring

3.5.1 AC Power supply

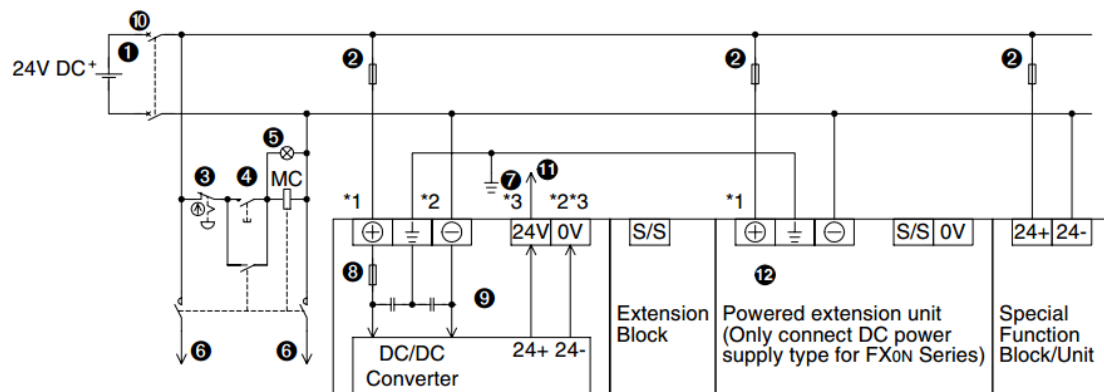


*1 It is recommended to use the same power source to power the main unit, powered extension units and special function blocks/units. If two sources are required, follow the below guidelines:

- Supply power to the powered extension units and special function blocks/units before or at the same time the main unit is powered.
- The power supplies may be cut the same time after ensuring system safety.

①	AC Power supply 100 - 240V AC, +10% -15%, 50 - 60 Hz	⑦	Grounding resistor 100Ω or less
②	Circuit protector or Fuse	⑧	Fuse
③	Emergency stop	⑨	Main unit
④	Power supply switch	⑩	Breaker
⑤	Power ON pilot indicator	⑪	DC Power supply 24V DC
⑥	Power supply for loads	⑫	Service Power Supply, 24V DC 400mA

3.5.2 24V DC Power supply



*1 It is recommended to use the same power source to power the main unit, powered extension units and special function blocks/units. If two sources are required, follow the below guidelines:

- Supply power to the powered extension units and special function blocks/units before or at the same time the main unit is powered.
- The power supplies may be cut the same time after ensuring system safety.

*2 Never connect the "0V" and the "-" terminals of a DC power supply type main unit.

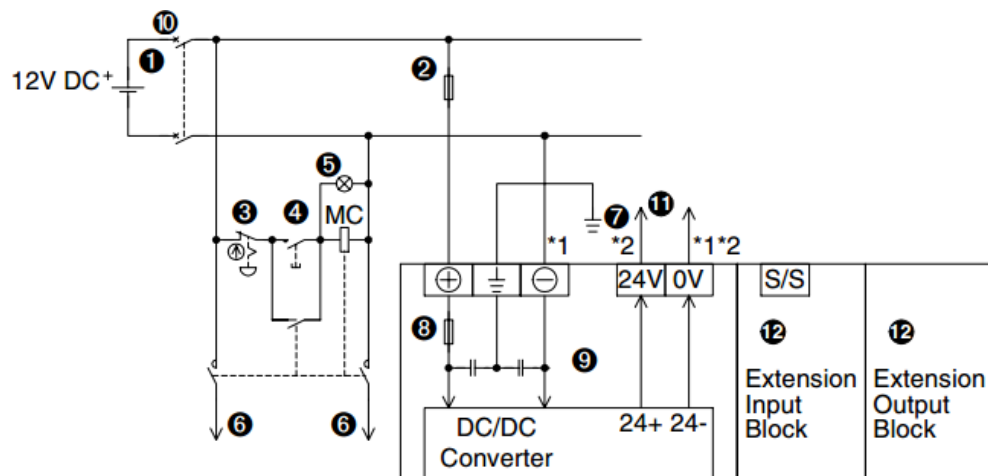
*3 When using a DC power supply type, it is the power source for an input extension block between "24V" and "0V" terminals.

Never supply an external power supply to these terminals.

Moreover, do not connect any equipment except an extension block to these terminals.

①	DC Power supply, 24V DC, +20%/-15%	⑥	Fuse
②	Circuit protector or Fuse	⑨	Main unit
③	Emergency stop	⑩	Breaker
④	Power supply switch	⑪	Power supply for the input circuitry of the main unit and extension blocks that are connected.
⑤	Power ON pilot indicator	⑫	Powered extension unit of 24V DC supply type
⑥	Power supply for loads		
⑦	Grounding resistor 100Ω or less		

3.5.3 12V DC Power Supply



*1 Never connect the "0V" and the "-" terminals of a DC power supply type main unit.

*2 When using a DC power supply type, it is the power source for an input extension block between "24V" and "0V" terminals.

Never supply an external power supply to these terminals.

Moreover, do not connect any equipment except an extension block to these terminals.

①	DC Power supply, 12V DC, +20%/-15%	⑧	Fuse
②	Circuit protector or Fuse	⑨	Main unit
③	Emergency stop	⑩	Breaker
④	Power supply switch	⑪	Power Supply for the input circuitry of the main unit and extension blocks that are connected.
⑤	Power ON pilot indicator	⑫	When using a 12V DC power supply, extension blocks occupying up to 32 I/O points are connected.
⑥	Power supply for loads		
⑦	Grounding resistor 100Ω or less		

3.6 Service Power supply

An AC powered LX1N can supply a service current of 24V DC at 400mA when used on its own and, when used with extension or special function blocks.

A DC powered LX1N does not have the capacity to supply a service current. However, additional extension blocks can be powered from the main unit's power supply.

3.7 Earthing / Grounding



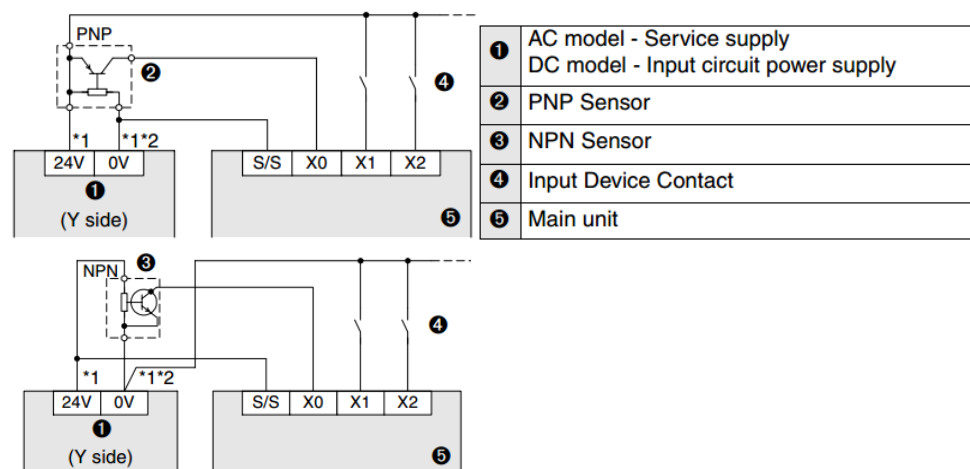
Use a cable at least 0.2mm²(AWG24) to ground equipment. Ground resistance must be less than 100Ω. Note that the ground cable must not be connected to the same ground as the power circuits.

4. Inputs

4.1 24V DC input Specifications

		LX1Nmain unit,extension block	
		X0 → X7	X10 → ∞
Input voltage		24V DC ±10%	
Input current		24V DC, 7mA	24V DC, 5mA
Input switching current	OFF → ON	>4.5mA	>3.5mA
	ON → OFF	<1.5mA	
Response time		10ms	
Variable response time		X000-X007 0-15ms	-
Circuit isolation		Photocoupler	
Operation indication		LED is lit	

4.1.1 Typical Wiring



Note: The input circuit power supply provides a clean+24VDC supply for the inputs. Hence use an external+24VDC power supply at your own risk.

The input circuit power supply cannot provide a service supply to special function blocks (SFB). Use an external supply to power the SFBs.

When using an AC powered unit, an external 24V DC supply can be used.

*1 When using a DC power supply type, it is the power source for an input extension block between "24V" and "0V" terminals.

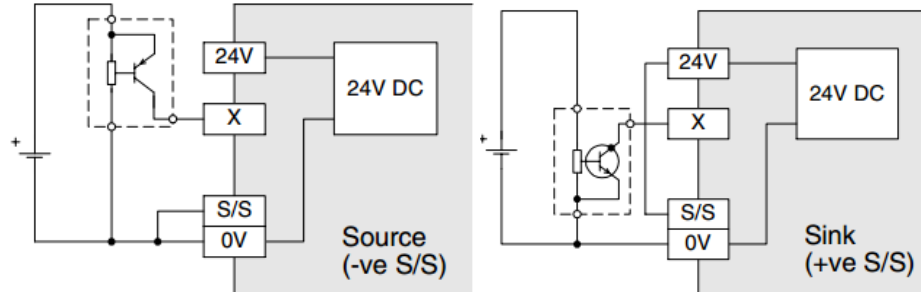
Never supply an external power supply to these terminals.

Moreover, do not connect any equipment except an extension block to these terminals.

*2 Never connect the "0V" and the "-" terminals of a DC power supply type main unit.

4.1.2 Input Circuit Connection

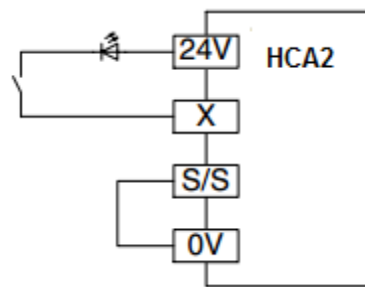
LX1N Main Units



4.1.3 Diodes and Inputs Connected in Series

Vdrop across the diode Max. 4V

No more than 2 LEDs should be connected in series.



4.1.4 Resistors and Inputs Connected in Parallel

Parallel resistance R_p : LX1N= 15k Ω . If resistance R_p is less than the stated value, then add

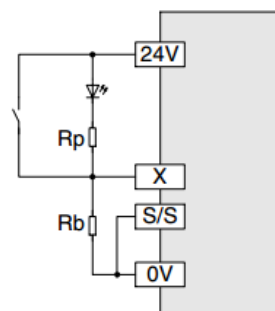
R_b . See equation 1 for R_b calculation.

Alternatively; Current leakage: LX1N= 1.5mA. If the current leakage is greater than the stated value, then add R_b . See equation 2 for R_b calculation.

Parallel LED

$$\text{Eqn 1 : } R_b \leq \frac{4R_p}{15 - R_p}$$

$$\text{Eqn 2 : } R_b \leq \frac{6}{I - 1.5}$$



4.2 AC110V Input Extension Block

Input voltage	85-132V AC 50-60Hz
Input impedance	21k Ω /50Hz 18k Ω /60Hz
Input current	4.7mA 100V AC/50Hz 6.2mA 110V AC/60Hz
OFF $\rightarrow$ ON/ON $\rightarrow$ OFF; input switching current	80V 3.8mA/30V 1.7mA
Response time	25ms
Circuit isolation / Operation indication	Photocoupler/LED is lit

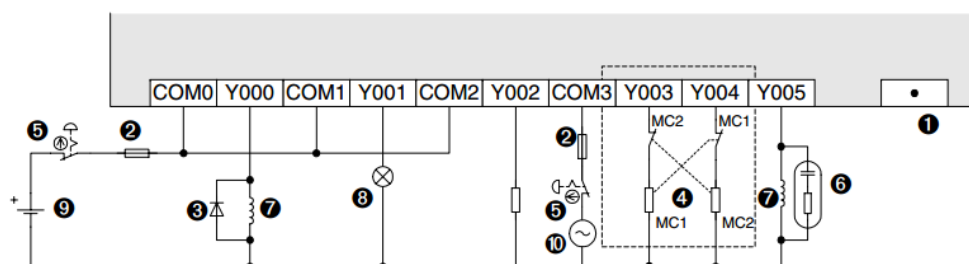
5. Outputs

5.1 Output Specifications

Description		Relay Output	Transistor Output
Switched voltages (resistive load)		$\leq 240V$ AC, $\leq 30V$ DC	5-30V DC
Rated current / N points (resistive load)		2A/1 point, 8A/COM	0.5A/1 point, 0.8A/COM
Max. Inductive load		80VA, 120/240V AC	12W/24V DC
Minimum load		When supply voltage < 5V DC allow at least 2mA flow	
Response time (approx.)	OFF $\rightarrow$ ON	10ms	< 0.2ms; < 5 μ s (Y000,Y001 only)
	ON $\rightarrow$ OFF	10ms	< 0.2ms (I > 0.2A); < 5 μ s (Y000,Y001 only)
Circuit isolation		By Relay	By Photo Coupler
Open circuit current leakage		-	0.1mA/30V DC
Operation indication		LED is lit when coil is energized	
Output protection	Internal device	None	
	Outside device (Fuse)	Rated value according to the load.	

5.2 Relay Output Example

Typical Relay



❶	Do not use this terminal	❷	Inductive load
❷	Fuse	❸	Incandescent Lamp
❸	Reverse-current protection diode (See section 6.4)	❹	DC Power Supply
❹	External Mechanical Interlock (See section 6.4)	❺	AC Power Supply
❺	Emergency Stop		
❻	Surge absorber (0.1μF capacitor + 100-200Ω resistor) (See section 6.4)		

5.2.1 Product life of relay contacts



The product life of relay contacts considerably varies depending on the load type used. Take care that loads generating reverse electromotive force or rush current may cause poor contact or deposition of contacts which may lead to considerable reduction of the contact product life.

1) Inductive load

Inductive loads generate large reverse electromotive force between contacts at shutdown may cause arcing. At a fixed current consumption, as the power factor (phase between current and voltage) gets smaller, the arc energy gets larger.

The test results in table 6.1 were gathered from a 1 sec ON/OFF test cycle.

Please note that the over current induced by in-rush greatly reduces the relay contacts life.

The rated life for an inductive AC load such as a contactor or solenoid valve is 500,000 operations at 20VA.

Table 6.1:

	20VA	35VA	80VA
Load capacity	0.2A/100VAC 0.1A/200VAC	0.35A/100V AC 0.15A/240V AC	0.8A/100V AC 0.33A/240V AC
Life of contact (cycles)	3,000,000	1,000,000	200,000

The product life of relay contacts becomes considerably shorter than the above conditions when the rush overcurrent is shut down.

* For countermeasures while using inductive loads, refer to "Output circuit configuration" below in this section.

Some types of inductive loads generate rush current 5 to 15 times the stationary current at activation. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

2) Lamp load

Lamp loads generally generate rush current 10 to 15 times the stationary current.

Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

3) Capacitive load

Capacitive loads can generate rush current 20 to 40 times the stationary current.

Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load. Capacitive loads such as capacitors may be present

in electronic circuit loads including inverters.

* For the maximum specified resistance load, refer to Section 6.1.

5.2.2 Output circuit configuration

An internal protection circuit for the relays is not provided in the relay output circuit for this product. It is recommended to use inductive loads with built-in protection circuits. When using loads without built-in protection circuits, insert an external contact protection circuit, etc. to reduce noise and extend the product life.

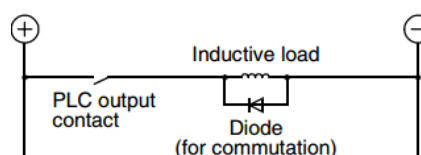


1) DC load

Connect a diode in parallel with the load.

The diode (for commutation) must comply with the following specifications.

Item	Guide
Reverse voltage	5 to 10 times the load voltage
Forward current	Load current or more

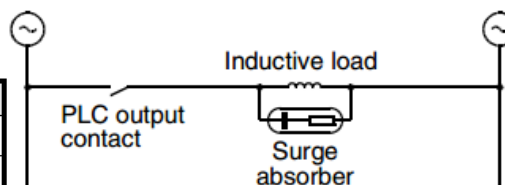


2) AC load

Connect the surge absorber shown to the right (combined CR components such as a surge killer and spark killer, etc.) parallel to the load.

Select the rated voltage of the surge absorber suitable to the output used. Refer to the table below for other specifications.

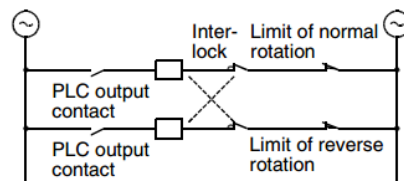
Item	Guide
Electrostatic capacitance	Approx. 0.1 μ F
Resistance value	Approx. 100 to 200 Ω



3) Interlock

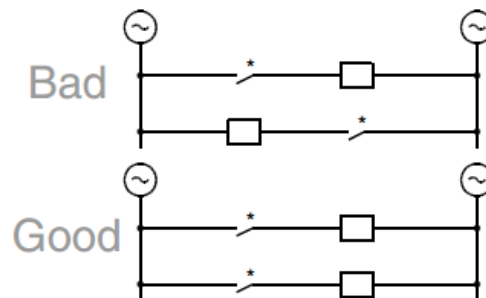
For loads such as forward/reverse contactors, etc., where a hazardous condition could result if switched

ON simultaneously, an external interlock should be provided for interlocking the PLC's internal programs as shown to the right.



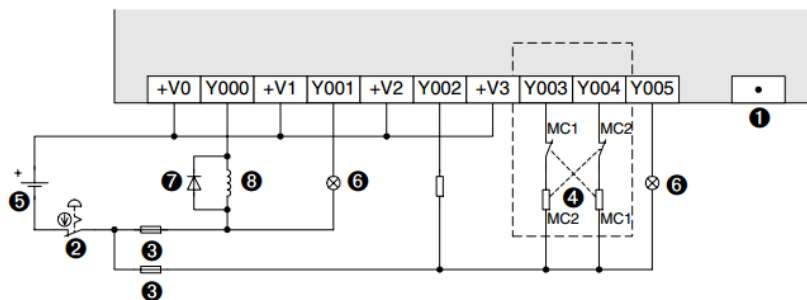
4) In-phase

PLC output contacts (*) should be used in an "in-phase" manner.



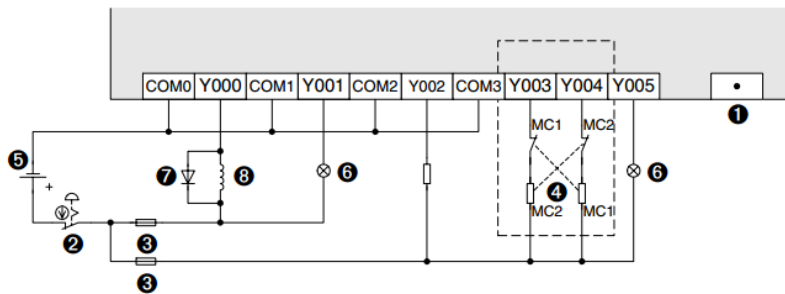
5.3 Transistor Output Example

5.3.1 Transistor Output Writing Diagram (Source Type)



❶	Do not use this terminal
❷	Emergency Stop
❸	Fuse
❹	External Mechanical Interlock (See Section 6.4)
❺	DC Power Supply
❻	Incandescent Lamp
❼	Reverse-current protection diode
❽	Inductive load

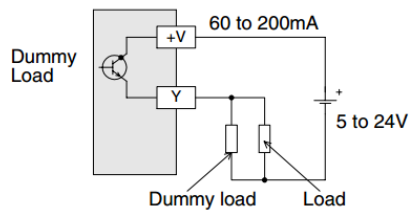
5.3.2 Japanese Model Transistor Output (Sink Type)



5.3.3 Response Times

OFF times increase as the load current decreases.

For improved response times use a 'dummy' resistor, see the figure below. If a response time of 0.5 ms or better is required when using 'light loads' use a 'dummy' resistor and ensure the signal line has a current greater than 60mA/24V DC



Y000 and Y001 are high speed response outputs with the following characteristics:

10 - 100mA at 5 - 24V DC, 100kHz maximum output

signal.

If a high speed response is required, a current of 10 - 100mA must be used.

5.3.4 External wiring precaution

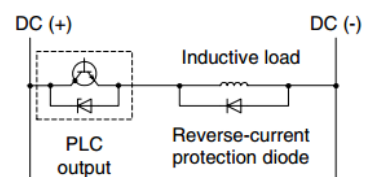


1) Contact protection circuit for inductive loads

Transistor outputs use internal zener diode (50V) as protection circuitry. When driving the inductive load with transistor output, a reverse-current protection diode can be installed in parallel with the load if necessary.

The reverse-current protection diode needs to satisfy the following specifications.

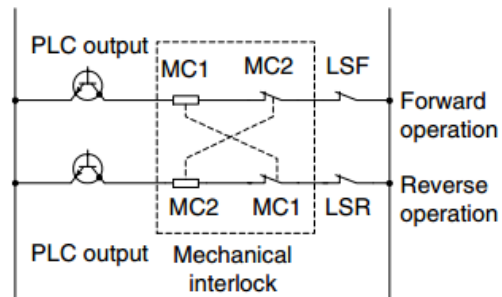
- Choose a commutating diode that has a reverse voltage strength over 5 - 10 times the load voltage, and a forward current over the load current.





2) Mechanical Interlock

Ensure all loads are applied to the same side of each PLC output, see previous figures. Loads which should NEVER simultaneously operate (e.g. direction control of a motor), because of a critical safety situation, should not rely on the PLC's sequencing alone. Mechanical interlocks MUST be fitted to all critical safety circuits. (See proceeding figure.)



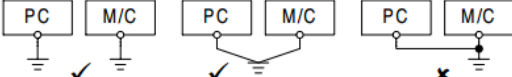
6. Diagnostics

6.1 Preliminary Checks

POWER ☐ RUN ☐ ERROR ☐	Check power supply, ground and I/O cables are wired correctly.
POWER ☒ RUN ☐ ERROR ☐	Turn the power supply on. Check that the power LED is lit. Download a small test program to the PLC. Verify the program to ensure it has been written to the PLC correctly. Using the programming device, force each output ON/OFF. Check the output LEDs for operation.
POWER ☒ RUN ☒ ERROR ☐	Put the PLC into RUN. Check the RUN LED is lit. Check that the previously down loaded program works correctly. Once all checks are complete take the PLC out of run and turn OFF the power supply.
	During this testing stage take extreme care not to touch any live or hazardous parts.

6.2 ERROR LED ON (CPU ERROR)

POWER ☒ RUN ☐ ERROR ☒	Fault ERROR LED ON	Remedy Reset PLC. Power OFF, ON and trigger RUN input.	Possible results	LED OFF	Has the memory cassette been installed or removed while the units has still been powered?
				LED is lit	A

A	Remedy Power OFF Disconnect earth/ground terminal Power ON	Possible results	LED is lit	B
	LED is flashing		Check for programming error. Ensure the earth/ground cable is correctly rewired. 	
B	Remedy Possible program/scan time error. Check D8012 for program scan time, (units 0.2 ms must be less than 0.2 s, i.e data value <2000).	Possible results D8012 > D8000		

6.3 Common Errors

- Corroded contact points at some point in an I/O line.
- An I/O device has been used outside its specified operating range.
- An input signal occurs in a shorter time period that taken by one program scan.

6.4 Maintenance

- Check interior temperature of the panel.
- Check panel air filters if fitted.
- Check for loosening of terminals or mounting facilities (due to vibration)

6.5 Operation and Error Flags

M8004 (ref. 8004)	Error occurrence (ON when M8060-7 are ON)	M8061 (ref. D8061)	PC hardware error
		M8063 (ref. D8063)	Parallel link error
		M8064 (ref. D8064)	Parameter error
		M8065 (ref. D8065, D8069)	Syntax error
		M8066 (ref. D8066, D8069)	Program (circuit) error
		M8067 (ref. D8067, D8069)	Program execution error
		M8068 (ref. D8068)	Execution error latch
M8035	Forced RUN mode		
M8036	Forced RUN signal		
M8037	Forced STOP signal		
M8039 (ref. D8039)	Constant scan mode		

6.6 PLC Status Registers

D8000 (default 200ms)	Watchdog timer
D8001	PLC version 26100 = HCA2 Version 1.00 26 = HCA2 , 100 = Version 1.00
D8002	Memory capacity 0008=8K steps
D8003	Memory type 02H=EEPROM protect switch OFF 0AH=EEPROM protect switch ON 10H=MPU memory
D8004	Error flag number 8060=M8060, (8060-8068)

6.7 Error Registers

D8061	Error code for PLC hardware error
D8063	Error code for parallel link fault
D8064	Parameter error code
D8065	Syntax error code
D8066	Program (circuit) error code
D8067	Program execution error code
D8068	Latched step number of execution error
D8069	Step number of errors associated with error flags M8065-M8067

6.8 Error Codes

D8061	Check cable connections	
	0000	No error
	6101	RAM error
	6102	Operation circuit error
D8062	Check the programmer / PC connections	
	0000	No error
	6201	Parity/overrun/framing error
	6202	Character error
	6203	Data sum check error
	6204	Data format error
	6205	Command error
D8063	Check both power and communications connections	
	0000	No error
	6301	Parity/overrun/framing error
	6302	Character error
	6303	Data sum check error
	6304	Data format error
	6305	Command error
	6306	Watchdog timer error

6.9 Instruction List

		0	1	2	3	4	5	6	7	8	9
000	Program Flow	CJ	CALL	SRET	IRET	EI	DI	FEND	WDT	FOR	NEXT
010	Transfers, Comp	CMP	ZCP	MOV			BMOV			BCD	BIN
020	+ - x /, Logics	ADD	SUB	MUL	DIV	INC	DEC	WAND	WOR	WXOR	
030	Shift					SFTR	SFTL			SFWR	SFRD
040	Data Operation	ZRST	DECO	ENCO							
050	High Speed	REF		MTR	HSCS	HSCR		SPD	PLSY	PWM	PLSR
060	Handy Instructions	IST		ABSD	INCD			ALT	RAMP		
070	I/O Devices			DSW		SEGL				FROM	TO
080	Serial Devices	RS	PRUN	ASCI	HEX	CCD	VRRD	VRSC		PID	□
150	Positioning						ABS	ZRN	PLSV	DRVI	DRVA
160	Real Time Clock	TCMP	TZCP	TADD	TSUB			TRD	TWR		HOURL
170	Special Comms							RD3A	WR3A		
220	In-line Compare					LD=	LD>	LD<		LD≠	LD≤
230		LD≥		AND=	AND>	AND<		AND≠	AND≤	AND≥	
240		OR=	OR>	OR<		OR≠	OR≤	OR≥			

	Symbol	FNC No	D	P		Symbol	FNC No	D	P		Symbol	FNC No	D	P
A	ABS	155			E	EI	004			P	PID	88		
	ABSD	062				ENCO	042				PLSR	059		
	ADD	020				FEND	006				PLSV	157		
	ALT	066				FOR	008				PLSY	057		
	AND□	232-238				FROM	078				PRUN	081		
B	ASCI	082			H	HEX	083			R	PWM	058		
	BCD	018				HOURL	169				RAMP	067		
	BIN	019				HSCR	054				REF	050		
C	BMOV	015			I	HSCS	053			S	RD3A	176		
	CALL	001				INC	024				RS	080		
	CCD	084				INCD	063				SEGL	074		
	CJ	000				IRET	003				SFRD	039		
D	CMP	010			L	IST	060			S	SFTL	035		
	DEC	025				LD□	224-230				SFTR	034		
	DECO	041			M	MOV	012				SFWR	038		
	DI	005				MTR	052				SPD	056		
	DIV	023			N	MUL	022				SRET	002		
	DRVA	159				NEXT	009				SUB	021		
	DRVI	158			O	OR□	240-246							
	DSW	072												

	Symbol	FNC No	D	P		Symbol	FNC No	D	P		Symbol	FNC No	D	P
T	TADD	162			V	VRRD	085			Z	ZCP	011		
	TCMP	160				VRSC	086				ZRN	156		
	TO	079				WAND	026				ZRST	040		
	TRD	166			W	WDT	007							
	TSUB	163				WOR	027							
	TWR	167				WR3A	177							
	TZCP	161				WXOR	028							

6.10 Device List

Item		Specification	Remarks
Program capacity		8k steps	Provided by built in EEPROM memory
I/O configuration		Max hardware I/O configuration points 128, dependent on user selection (Max. software addressable Inputs 128, Outputs 128)	
Auxiliary relay (M coils)	General	384 points	M0 to M383
	Latched (EEPROM backed-up)	1152 points EEPROM keep: 128 points Capacitor keep: 1024 points	M384 to M1535 EEPROM keep: M384 to M511 Capacitor keep: M512 to M1535
	Special	256 points	From the range M8000 to M8255
State relays (S coils)	Latched (EEPROM backed-up)	1000 points EEPROM keep: 128 points Capacitor keep: 872 points	S0 to S999 EEPROM keep: S0 to S127 Capacitor keep: S128 to S999
	Initial	10 points (subset)	S0 to S9
Timers ()	100 msec	200 points Range: 0 to 3,276.7 sec	T0 to T199
	10 msec	46 points	T200 to T245

		Range: 0 to 327.67 sec	
	1 msec retentive	4 point, Capacitor keep Range: 0 to 32.767 sec	T246 to T249
	100 msec retentive	6 points, Capacitor keep Range: 0 to 3,276.7 sec	T250 to T255
Counters (C)	General	16 points Range: 1 to 32,767 counts	C0 to C15 Type: 16 bit up counter
	Latched (EEPROM backed-up)	184 points Range: 1 to 32,767 counts EEPROM keep: 16 points Capacitor keep: 168 points	C16 to C199 EEPROM keep: C16 to C31 Capacitor keep: C32 to C199 Type: 16 bit up counter
	General	20 points Range: -2,147,483,648 to 2,147,483,647 counts	C200 to C219 Type: 32 bit bi-directional counter
	Latched (EEPROM backed-up)	15 points, Capacitor keep Range: -2,147,483,648 to 2,147,483,647 counts	C220 to C234 Type: 32 bit bi-directional counter
High speed counters (C) Max. 6 points	1 phase	Range: -2,147,483,648 to +2,147,483,647 counts General rule: Select counter combinations with a combined counting frequency of 60kHz or less. Note; all counters are latched (EEPROM backed-up) If high speed counter is used with the HSCS or HSCR instruction, a combined counting frequency of 30kHz or less	C235 to C240, 6 points
	1 phase c/w start stop input		C241to C245, 5 points
	2 phase		C246 to C250, 5 points
	A/B phase		C251 to C255, 5 points
Data registers (D)	General	128 points	D0 to D127 Type: 16 bit data storage register pair for 32 bit device
	Latched (EEPROM backed-up)	7872 points EEPROM keep: 128 points Capacitor keep: 7744 points	D128 to D7999 EEPROM keep: D128 to D255 Capacitor keep: D256 to D7999 Type: 16 bit data storage register pair for 32 bit device
	File	Maximum 7000 points	D1000 to D7999 set by parameter in 14 blocks of 500 program steps Type: 16 bit data storage register

	Externally adjusted	2 points Range: 0 to 255	D8030 & D8031 Data is entered indirectly through the external setting potentiometer
	Special	256 points (inclusive of D8030 and D8031)	From the range D8000 to D8255 Type: 16 bit data storage register
	Index	16 points	V and Z Type: 16 bit data storage register
Pointers (P)	For use with CALL	128 points	P0 to P127
	For use with interrupts	6 points	I00□ to I50□ (rising trigger □ = 1, falling trigger □ = 0)
Nest levels		8 points for use with MC and MCR	N0 to N7
Constants	Decimal K	16 bit: -32,768 to +32,767 32 bit: -2,147,483,648 to +2,147,483,647	
	Hexadecimal H	16 bit: 0000 to FFFF 32 bit: 00000000 to FFFFFFFF	